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CHEW, BRIAN

ART UNIT	PAPER NUMBER
2195	

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Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

	Application No.	Applicant(s)
Office Action Summary	10/576,961	LIU ET AL.
	Examiner	Art Unit	
	BRIAN CHEW	2195	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE <u>3</u> MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.
- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
  Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on <u>09 July 2010</u>.

2a)☒ This action is **FINAL**.   2b)☐ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) <u>1-24</u> is/are pending in the application.

    4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) <u>1-24</u> is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

    Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

    Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

    a)☐ All b)☐ Some * c)☐ None of:

    1.☐ Certified copies of the priority documents have been received.

    2.☐ Certified copies of the priority documents have been received in Application No. _____.

    3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

    * See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1)☒ Notice of References Cited (PTO-892)

2)☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)

3)☒ Information Disclosure Statement(s) (PTO/SB/08)
    Paper No(s)/Mail Date <u>7/9/2010</u>.

4)☐ Interview Summary (PTO-413)
    Paper No(s)/Mail Date. _____.

5)☐ Notice of Informal Patent Application

6)☐ Other: _____.

DETAILED ACTION

1.   Claims 1-24 are presented for examination.

Claim Objections

2.   Claims 6 and 19 are objected to because of the following informalities:

        i.   As per claim 6: Line 2: There appears to be a typographical error at
        "kernal". This shall be corrected to read -- kernel --. Appropriate correction is
        required.

        ii.   As per claim 19: Line 2: There appears to be a typographical error at
        "comprise". This shall be corrected to read -- comprises --. Appropriate
        correction is required.

Claim Rejections - 35 USC § 101

35 U.S.C. 101 reads as follows:

Whoever invents or discovers any new and useful process, machine, manufacture, or composition of
matter, or any new and useful improvement thereof, may obtain a patent therefor, subject to the
conditions and requirements of this title.

3.   **Claims 9-24 are rejected under 35 U.S.C. 101 because the claimed invention
is directed to non-statutory subject matter.**

4.   As per claim 9, it recites a "virtual machine monitor"; however, it appears that the
virtual machine monitor would reasonably be interpreted by one of ordinary skill in the

art as software, per se, failing to be tangibly embodied or include any recited hardware as part of the virtual machine monitor. Software alone is directed to a non-statutory subject matter. Applicant is advised to amend the claims to include hardware (e.g., computer storage) to overcome the §101 rejection.

5.   As per claims 10-16, they are dependent on claim 9 but do not overcome the deficiencies of claim 9; therefore, they are rejected for the same reasons.

6.   As per claim 17, it recites a "computer-readable medium" that is not limited to tangible embodiments, instead being defined in the specification, page 4 lines 1-9, to include both tangible embodiments (e.g., ROM, RAM, magnetic disk storage) and intangible embodiments (e.g., propagated signals, carrier waves). Applicant is advised to amend the claim to read -- computer readable storage medium --.

7.   As per claims 18-24, they are dependent on claim 17 but do not overcome the deficiencies of claim 17; therefore, they are rejected for the same reasons.

Claim Rejections - 35 USC § 102

(b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

8.   **Claims 1-3, 5-11, 13-20 and 22-24 are rejected under 35 U.S.C. 102(b) as being anticipated by Sugerman et al. ("Virtualizing I/O Devices on VMware Workstation's Hosted Virtual Machine Monitor"; hereinafter Sugerman).**

9.   As per claim 1, Sugerman teaches a method comprising:

- determining that a device related operation happens in a virtual machine by a kernel

   component of a virtual machine monitor through an operation transition from the

   virtual machine to the kernel component *(section 2, paragraph 2, lines 5-6; section 2,*

   paragraph 6, line 3; section 2.1, paragraph 2, lines 1-6); and

- determining whether the device related operation can be handled by a first virtual

   input/output device installed inside of the kernel component of the virtual machine

   monitor *(section 2, paragraph 2, lines 5-6; section 2, paragraph 6, line 3; section 2.1,*

   paragraph 2, lines 7-12; section 2.2, paragraph 4, lines 2-4).

10.   As per claim 2, Sugerman teaches the method of claim 1, wherein the first virtual

device comprises at least one of a virtual keyboard, virtual mouse, virtual audio device,

virtual video device, virtual event timer and virtual interrupt controller *(section 2.1,*

paragraph 1, lines 2-9).

11.   As per claim 3, Sugerman teaches the method of claim 1, wherein the virtual

machine monitor is a hybrid virtual machine monitor *(section 2, paragraph 2, lines 5-6;*

section 2, paragraph 3, lines 1-2).

12.   As per claim 5, Sugerman teaches the method of claim 1, wherein the virtual

machine monitor is a host virtual machine monitor *(section 1, paragraph 2, lines 2-4;*

figure 2, VMM hosts virtual machine(s) in VMM world).

13.   As per claim 6, Sugerman teaches the method of claim 5, wherein the kernel

component is a kernel virtual machine monitor *(section 2, paragraph 2, lines 5-6;*

section 2, paragraph 6, line 3; section 2.1, paragraph 2, lines 1-6).

14.   As per claim 7, Sugerman teaches the method of claim 1, further comprising

passing the device related operation to a second virtual input/output device installed

outside of the kernel component of the virtual machine monitor, in response to

determining that the device related operation can not be handled by the first virtual

input/output device *(section 2.1, paragraph 2, lines 7-12; section 2.2, paragraph 4, lines*

1-2; section 2.3, paragraph 3, lines 5-9; section 3.3, paragraph 2, lines 1-8).

15.   As per claim 8, Sugerman teaches the method of claim 1, further comprising:

- initiating an interrupt by the first virtual input/output device *(section 2.3, paragraph 2,*
  lines 5-6); and

- injecting the interrupt from the first virtual input/output device to the virtual machine
  through another operation transition from the kernel component to the virtual
  machine *(section 1, paragraph 2, lines 7-8; section 2.3, paragraph 2, lines 5-8).*

16.   As per claim 9, Sugerman teaches a virtual machine monitor, comprising:

- a kernel component to determine that a device related operation happens in a virtual

  machine through an operation transition from the virtual machine to the kernel

  component *(section 2, paragraph 2, lines 5-6; section 2, paragraph 6, line 3; section*

  2.1, paragraph 2, lines 1-6),

- wherein the kernel component further comprises a first virtual input/output device

  (section 2, paragraph 2, lines 5-6; section 2, paragraph 6, line 3; paragraph 4, lines

  2-4).

17.   As per claims 10-11, they are rejected for the same reasons as stated in the

rejection of claims 2-3.

18.   As per claim 13, it is rejected for the same reasons as stated in the rejection of

claim 5.

19.   As per claims 14, Sugerman teaches the monitor of claim 13, wherein the kernel

component is a kernel virtual machine monitor of a host operating system *(section 2,*

paragraph 2, lines 5-6; section 2, paragraph 6, line 3-5; section 2.1, paragraph 2, lines

1-6).

20.   As per claims 15, Sugerman teaches the monitor of claim 9, further comprising a

second virtual device installed outside of the kernel component of the virtual machine

monitor to handle the device related operation in response to determining that the
device related operation can not be handled by the first virtual device *(section 2.1,
paragraph 2, lines 7-12; section 2.2, paragraph 4, lines 1-2; section 2.3, paragraph 3,
lines 5-9; section 3.3, paragraph 2, lines 1-8)*.

21.   As per claims 16, Sugerman teaches the monitor of claim 9, wherein the first
virtual input/output device is further to initiate an interrupt and inject the interrupt from
the first virtual input/output device to the virtual machine through another operation
transition from the kernel component to the virtual machine *(section 1, paragraph 2,
lines 7-8; section 2.3, paragraph 2, lines 5-8)*.

22.   As per claims 17, Sugerman teaches a computer-readable medium comprising a
plurality of instructions *(figure 2, all software components are embodied on physical
machine; section 2, paragraph 2, lines 1-6)*, which when executed result in an
apparatus:

- determining that a device related operation happens in a virtual machine by a kernel
  component of a virtual machine monitor through an operation transition from the
  virtual machine to the kernel component *(section 2, paragraph 2, lines 5-6; section 2,
  paragraph 6, line 3; section 2.1, paragraph 2, lines 1-6)*;

- determining whether the device related operation can be handled by a first virtual
  hardware device installed inside of the kernel component of the virtual machine

monitor *(section 2, paragraph 2, lines 5-6; section 2, paragraph 6, line 3; section 2.1, paragraph 2, lines 7-12; section 2.2, paragraph 4, lines 2-4)*; and

- passing the device related operation to a second virtual hardware device installed outside of the kernel component of the virtual machine monitor, in response to determining that the device related operation can not be handled by the first virtual hardware device *(section 2.1, paragraph 2, lines 7-12; section 2.2, paragraph 4, lines 1-2; section 2.3, paragraph 3, lines 5-9; section 3.3, paragraph 2, lines 1-8)*.

23.   As per claims 18, Sugerman teaches the medium of claim 17, wherein the first virtual hardware device comprises at least one of a virtual input/output device, virtual interrupt controller, and virtual event timer *(section 2.1, paragraph 1, lines 2-9; section 2.2, paragraph 4, lines 1-2)*.

24.   As per claims 19, Sugerman teaches the medium of claim 17, wherein the second virtual hardware device comprise at least one of a virtual input/output device, virtual interrupt controller, and virtual event timer *(section 2.1, paragraph 1, lines 2-9; section 2.2, paragraph 4, lines 1-2)*.

25.   As per claims 20, it is rejected for the same reasons as stated in the rejection of claim 3.

26.   As per claims 22-23, they are rejected for the same reasons as stated in the

rejection of claims 5-6.

27.   As per claims 24, Sugerman teaches the medium of claim 17, wherein the

plurality of instructions further result in the apparatus:

- initiating an interrupt by the first virtual hardware device (*section 2.3, paragraph 2,*

  lines 5-6); and

- injecting the interrupt from the first virtual hardware device to the virtual machine

  through another operation transition from the kernel component to the virtual

  machine (*section 1, paragraph 2, lines 7-8; section 2.3, paragraph 2, lines 5-8*).

Claim Rejections - 35 USC § 103

        The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all

obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set
> forth in section 102 of this title, if the differences between the subject matter sought to be patented and
> the prior art are such that the subject matter as a whole would have been obvious at the time the
> invention was made to a person having ordinary skill in the art to which said subject matter pertains.
> Patentability shall not be negatived by the manner in which the invention was made.

28.   **Claims 4, 12 and 21 are rejected under 35 U.S.C. 103(a) as being**

unpatentable over Sugerman in view of Barham et al. ("Xen and the Art of

Virtualization"; hereinafter Barham).

29.   As per claim 4, Sugerman teaches the method of claim 3, but is silent on wherein

the kernel component is a hypervisor of the hybrid virtual machine monitor.

Barham teaches wherein the kernel component is a hypervisor of the hybrid

virtual machine monitor *(section 2, paragraph 15, lines 7-9; section 2.3, paragraph 1,*

lines 3-4).

One of ordinary skill in the art at the time the invention was made would have

been motivated to modify Sugerman with the teachings of Barham to allow "multiple

commodity operating systems to share conventional hardware in a safe and resource

managed fashion, but without sacrificing either performance or functionality" *(abstract,*

paragraph 2, lines 2-4).

30.   As per claims 12 and 21, they are rejected for the same reasons as stated in the

rejection of claim 4.

Response to Arguments

31.   Applicant's arguments filed 9 July 2010 with respect to the rejection under 35

U.S.C. 112, second paragraph, have been fully considered and are persuasive. The

rejection of claims 1-2, 5-6, 8-9, 11, 13-14, 16 and 25 has been withdrawn.

32.   Applicant's arguments filed 9 July 2010 have been fully considered but they are

not persuasive.

33.   As per the rejection of claims 9-24 under 35 U.S.C. 101, Applicant argues that

claim amendments overcome the rejection. Examiner respectfully disagrees. Claims 9-

16 are directed to a virtual machine monitor that would reasonably interpreted to one of ordinary skill in the art as software, per se. Claims 17-24 are directed to a computer-readable medium that is not limited to tangible embodiments. As such, Applicant's arguments are non-persuasive.

34.   As per the rejection of claims 1-3, 5-11, 13-20 and 22-24 under 35 U.S.C. 102, Applicant argues that determining whether the device related operation can be handled by a first virtual device installed inside of the kernel component of the virtual machine monitor is unanticipated by Sugerman. Examiner respectfully disagrees.

        Sugerman teaches a privileged virtual machine monitor component that exports a number of virtual I/O ports and a virtual IRQ that represent the virtual network adapter in the virtual machine (*figure 4, virtual NIC in VMM; section 2, paragraph 2, lines 5-6; section 2.2, paragraph 4, lines 2-4*). The privileged virtual machine monitor has full system and hardware privileges (*section 2, paragraph 6, line 3*), thus the virtual machine monitor runs in kernel mode.

        Applicant correctly states that, while the VMM can potentially handle accesses not interacting with the hardware, accesses interacting with the hardware should be handled by the VMApp, which is supported in Sugerman, section 2.1, paragraph 2, lines 7-12. Thus, a determination is made as to whether a device related operation, an access, can be handled by the virtual NIC installed inside the kernel component of the virtual machine monitor.

Further, Applicant correctly states that virtualization of the NIC is implemented via virtual NIC, virtual network hub and virtual bridge, which is verified in Sugerman, section 2.2, paragraph 4, lines 1-2 teaching that the virtual NIC is implemented via a combination of code in the VMM and VM application. Although packets are sent and received via the virtual NIC emulation as the above, Applicant is reminded that, <u>while the VMM can potentially handle accesses not interacting with the hardware, accesses interacting with the hardware should be handled by the VMApp.</u>

Sugerman teaches, of intermediate I/O accesses, the ones to the virtual Lance's address register are handled completely within the VMM and all accesses to the data register switch back to handling code in the VMApp *(section 2.3, paragraph 3, lines 5-9)*. Sugerman further teaches that the only virtual I/O accesses that require world switch to the host are the ones that require a physical I/O device and that the remaining accesses merely modify the state of the virtual Lance data port, which can be easily done directly in the VMM without a world switch *(section 3.3, paragraph 2, lines 1-8)*. Thus, the device related operation is passed to the virtual NIC emulation in the host world when it is determined that the operation cannot be handled by the virtual NIC emulation in the VMM, such as during accesses interacting with a physical NIC.

For the reasons above, Applicant's arguments are non-persuasive.

Conclusion

35.   **THIS ACTION IS MADE FINAL.** Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE

MONTHS from the mailing date of this action. In the event a first reply is filed within

TWO MONTHS of the mailing date of this final action and the advisory action is not

mailed until after the end of the THREE-MONTH shortened statutory period, then the

shortened statutory period will expire on the date the advisory action is mailed, and any

extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of

the advisory action. In no event, however, will the statutory period for reply expire later

than SIX MONTHS from the mailing date of this final action.

36.   The prior art made of record and not relied upon is considered pertinent to

applicant's disclosure. Liu et al. (US 2008/0276258) teaches a virtual machine system

comprising a service OS, a hypervisor and at least one guest OS, where the service OS

contains a device model module providing an access platform for I/O to the guest OS.

Vega et al. (US 2006/0004554) teaches virtual device lists installed in a virtual machine

monitor.

37.   Any inquiry concerning this communication or earlier communications from the

examiner should be directed to BRIAN CHEW whose telephone number is (571)270-

5571. The examiner can normally be reached on Monday-Thursday, 8:00AM-5:00PM

EST.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's

supervisor, Meng-Ai An can be reached on (571)272-3756. The fax phone number for

the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the

Patent Application Information Retrieval (PAIR) system. Status information for

published applications may be obtained from either Private PAIR or Public PAIR.

Status information for unpublished applications is available through Private PAIR only.

For more information about the PAIR system, see http://pair-direct.uspto.gov. Should

you have questions on access to the Private PAIR system, contact the Electronic

Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a

USPTO Customer Service Representative or access to the automated information

system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

/B. C./
Examiner, Art Unit 2195

/Li B. Zhen/
Primary Examiner, Art Unit 2194